question as to the proportion of popularly elected managers which should act as bodies controlling the work of voluntary and denominational schools. The clause as amended provides that the management board of every public elementary school not provided by the local educational authority shall consist of four foundation or trust managers and two managers appointed by elected bodies. This principle has been accepted as part of the Bill. The discussion of the whole question of the machinery by which the managers of voluntary schools are to be elected has been postponed until the autumn session.

THE Ministerial changes consequent upon the resignation of Lord Salisbury, and the appointment of Mr. Balfour as Premier, involve a reconstitution of the representatives of the Board of Education in Parliament. Sir John Gorst, who has been Vice-President of the Committee of Council for Education since 1895, has resigned, and his office becomes extinct. The Duke of Devonshire remains Lord President of the Council, but ceases to preside over the Education Department. The newly constituted Board of Education has for its President the Marquis of Londonderry, who was chairman of the London School Board some years ago, and as Parliamentary Secretary Sir William Anson, member for the University of Oxford and a leading authority upon educational matters. The Duke of Devonshire will therefore no longer be directly concerned with departmental work in education, though he will have charge of the Education Bill when it reaches the House of Lords.

THERE is a feminine and a masculine type of mind. The former depends chiefly on memory and being reproductive ; the other relies upon reasoning and being creative. The mind of the man of science is masculine, that of the clergyman is feminine. Not every woman possesses a feminine mind, though many men have little else. The whole of our education from top to bottom is essentially feminine, chiefly because in its origin and continuance it is clerical. Such are but a few of the opinions expressed by Mr. James Swinburne in an article on "Feminine Mind Worship" in the current number of the *Westminster Review*. The whole article is a powerful appeal for a fuller recognition of the value in education of a rational training in the methods of science, so that boys may obtain at school such a practical acquaintance with experimental physics and chemistry as will lead them to develop their reasoning faculties and endow them with those powers of initiative which are essential, since the whole welfare and existence of a commercial country like ours depends on the application of science and the work of the despised masculine mind. Mr. Swinburne's essay deserves to be widely read.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society (2) viii. No. 9, June.—T. J. I'A. Bromwich, on the infinitesimal generators of parameter groups. The author gives a simplified method of calculating the generators of a group of known structure, and compares his results with those of Slocum (*Bulletin* for January). —E. V. Huntington, a second definition of a group. The definition is reduced to four independent postulates, to which a fifth must be added if a distinction is to be made between finite and infinite groups.—G. A. Miller, determination of all the groups of order p^m, p being any prime, which contain the Abelian group of order p^{m-1} and of type (1, 1, ...).—L. E. Dickson, a class of simply transitive linear groups.—D. N. Lehmer, errors in Legendre's tables of linear divisors.—Reviews of Gray's "Treatise on Physics," vol. i., Cellérier's "Cours de Mécanique" (E. B. Wilson), and Kiepert's "Grundriss der Differential- und Integral-Rechnung" (E. W. Davis).

Annals of Mathematics (2) iii. No. 4, July.—H. S. White, note on a twisted curve connected with an involution of pairs of points in a plane.—R. E. Allardice, on some curves connected with a system of similar conics.—J. Westlund, note on multiply perfect numbers.—W. R. Ransom, a mechanical construction of confocal conics.—P. F. Smith, on Sophus Lie's representation of imaginaries in plane geometry. This is an interesting commentary on Lie's first paper, published in the *Transactions* of the Academy of Christiania in 1869.—G. A. Miller, note on the group of isomorphisms of a group of order p^m.—L. D. Ames, evaluation of slowly convergent series.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 19.—"On the Measurement of Temperature." Part i.—On the Pressure Coefficients of Hydrogen and Helium at Constant Volume and at different Initial Pressures. Part ii.—On the Vapour Pressures of Liquid Oxygen at Temperatures below its Boiling Point on the Constant Volume Hydrogen and Helium Scales. Part iii.—On the Vapour Pressures of Liquid Hydrogen at Temperatures below its Boiling Point on the Constant Volume Hydrogen and Helium Scales. By Morris W. Travers, D.Sc., Fellow of University College, London, George Senter, B.Sc., and Adrien Jaquerod, D.Sc. Communicated by Prof. William Ramsay, F.R.S.

Part i. (M. W. T. and A. J.).—The pressure coefficients were determined by measuring the pressure which the gases exerted when the bulb of the constant-volume thermometer was surrounded with melting ice, or with steam at the boiling point. The apparatus employed cannot be described in this abstract ; it was completely constructed of soda-glass, and as all junctions were sealed in the blowpipe flame, leakage of the gas was impossible. By enclosing the manometer column and *dead space* between parallel glass plates in a water jacket, it was possible to measure the temperature of these parts of the apparatus to 0°·02 C. and thus eliminate errors which might seriously affect the results.

The pressure coefficient at an initial pressure of 700 millimetres in the case of either gas appears to have the value 0·00366255, which does not differ appreciably from that obtained by Chappuis for hydrogen at an initial pressure of 1000 millimetres of mercury. At a pressure of 520 millimetres no appreciable decrease in the value of the coefficient could be detected. As has hitherto been assumed, the pressure coefficient for hydrogen, and also for helium, appears to be independent of the pressure, so far as thermometric observations are concerned.

Part ii. (M. W. T., G. S. and A. J.).—Previous investigators have measured the boiling point and vapour pressures of liquid oxygen by immersing the thermometer in a mass of the liquid and measuring the pressure under which it was evaporating. This method is unsatisfactory on account of the difficulty of obtaining pure oxygen in sufficient quantity, and of the tendency of the liquid to become superheated.

In the experiments described in this paper, a bulb in which a small quantity of pure oxygen could be liquefied was immersed, together with the bulb of the thermometer, in a vacuum vessel containing liquid air or oxygen, through which a rapid current of air was passed. The bulb containing the pure oxygen communicated with the lower chamber of a barometer, so that measurements of the vapour pressures were quite independent of the atmospheric pressure.

Four thermometers were employed in these experiments, the capacities of the bulbs being approximately 90 c.c., 12 c.c., 26 c.c. and 27 c.c. The large thermometer was employed in one series of measurements only, as it was found to be difficult to maintain so large a bulb at a constant and definite temperature without employing very large quantities of liquid air. The temperatures obtained by means of the three smaller thermometers rarely differed by more than 0°·03 from the temperature, corresponding to the same pressure, taken from the smoothed vapour-pressure curve. The pressure on the gas at the ice point was in every case about 1000 mm. of mercury.

The thermometers were so constructed that the pressure on the gas could be measured independently of the atmospheric pressure. The temperature of the dead space was determined by means of a mercury thermometer, and the temperature of the vertical portion of the stem above the thermometer bulb was measured by means of an auxiliary gas thermometer, of similar construction, with a narrow cylindrical bulb of the same length as the stem. The coefficient of expansion of the glass was found to be 0·0000284 between 0° and 100° C., and 0·0000218 between 0° and −190° C.

Vapour Pressures of Liquid Oxygen.

Pressure in millimetres.			Temperature on hydrogen scale.			Temperature on helium scale.
800	...	...	90°·60	..	...	90°·70
760	...	...	90·10	...	...	90·20
700	...	...	89·33	...	...	89·43
600	...	...	87·91	...	...	88·01
500	...	...	86·29	...	...	86·39
400	...	...	84·39	...	...	84·49
300	...	...	82·09	...	...	82·19
200	...	...	79·07	...	...	79·17

Part iii. (M. W. T. and A. J.).—The three small thermometers used to measure the vapour pressures of liquid oxygen were also employed in the case of liquid hydrogen. The small bulb, which in the previous experiments had contained pure oxygen, now contained pure hydrogen. The agreement between the results obtained with different thermometers is indicated in the following table :—

I.—*Hydrogen Scale.*

Thermometer.	Vapour pressure of liquid hydrogen. mm.	Temperature. Found.	From curve.
A (12 c.c.)	... 757·2	... 20·17	... 20·21
B (26 c.c.)	... 766·6	... 20·28	... 20·25

II.—*Helium Scale.*

Thermometer.	Vapour pressure of liquid hydrogen. mm.	Temperature. Found.	From curve.
A (12 c.c.)	.. 765·0	... 20·42	... 20·44
,,	... 759·2	... 20·41	... 20·41
B (26 c.c.)	... 770·0	... 20·43	... 20·46
C (27 c.c.)	... 749·0	... 20·36	... 20·36

The vapour pressures were measured between the boiling and melting points. The results are as follows :—

Vapour Pressures of Liquid Hydrogen.

Pressure in millimetres.	Temperature on the hydrogen scale	Temperature on the helium scale.
800	... ... 20·41	... ... 20·60
760	... ... 20·22	... ... 20·41
700	... ... 19·93	... ... 20·12
600	... ... 19·41	... ... 19·61
500	... ... 18·82	... ... 19·03
400	... ... 18·15	... ... 18·35
300	... ... 17·36	... ... 17·57
200	... ... 16·37	... ... 16·57
100	... ... 14·93	... ... 15·13
50	... ... —	... ... 14·11

Though the pressure coefficients of hydrogen and helium between 0° and 100° C. show no appreciable difference, measurements of low temperatures on the scales of the two thermometers are not identical. It is probable that at the normal temperature both gases may be considered as so nearly perfect that the difference between the gas scale and the absolute scale is insignificant. As the critical point of helium lies much lower than that of hydrogen, measurements of low temperatures on the helium scale should approach more closely to absolute temperatures than measurements on the hydrogen scale. It is pointed out that helium should replace hydrogen as the normal thermometric substance.

The melting point of hydrogen was found to be 14°·10 on the helium scale.

The pure helium used in the thermometric measurements was obtained by passing purified cleveite gas through a coil cooled to 15° in liquid hydrogen boiling *in vacuo*. An unsuccessful attempt was made to liquefy this gas, which could not be condensed at 13° under a pressure of 60 atmospheres.

The vapour pressures of solid neon were measured at temperatures corresponding to 20°·4 (12·8 mm.) and 15°·65 (2·4 mm.). It was shown that the vapour pressure did not change as the solid evaporated, proving that neon is a homogeneous substance.
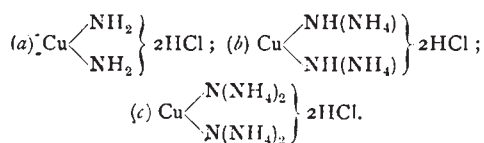
EDINBURGH.

Royal Society, July 21.—Prof. Geikie in the chair.—The Neill prize for 1898-1901 having been awarded to Dr. J. S. Flett for his papers entitled "The Old Red Sandstone of the Orkneys" and "The Trap Dykes of the Orkneys," Prof. Geikie, in making the award, recalled the important work which Dr. Flett had done in searching for and finding organic remains in rocks hitherto supposed to be unfossiliferous, and then in proving that these strata were divisible into definite zones, each characterised by its own particular fish fauna. The paper on the trap dykes could have been written only by one who was at once a skilled field geologist, a thoroughly equipped petrologist, an expert microscopist and a facile chemist.—In a further communication on magnetic shielding in hollow iron cylinders and superposed magnetic inductions in iron, Mr. James Russell discussed in particular the superposition of two magnetising forces at right angles to one another, and the magnetic æolotropy of demagnetised iron. Thus, if H_1 represent the field first acting and H_2 the field superposed at right angles to the first, and if B_1 and B_2 represent the resultant inductions in the directions of H_1 and H_2 respectively, then the general result was that with H_2 superposed on H_1 the B_1 component always lay above the B_2 component. For low fields the B_1 component is greater than in the normal case when no H_2 acts, but as the field is taken stronger the B_1 component approaches the normal value, and finally in high enough fields falls below it. The B_2 component lies below the normal value with this exception, that with low values of H_1 there is a slight excess of the B_2 component over the normal value. Then again, as regards æolotropy the following result was established. During the early stages of induction, iron is more permeable to a force in the same direction as that used in the immediately preceding process of demagnetising by reversals than it is to one at right angles to it. The results were discussed in terms of the recognised theories of molecular magnetism.—Dr. W. Peddie, in an additional note on the use of quaternions in the theory of screws, applied his method of interpretation to the case of a rigid body moving with two degrees of freedom, and was led to the investigation of the elliptic cylindroid, which differs from the ordinary cylindroid by being referred to an elliptic cylinder instead of to a right cylinder. Further developments were also given.—Prof. C. G. Knott read the second part of a paper on change of resistance of nickel due to magnetisation at different temperatures. The apparatus was the same as that already described, but by a modification in the method of experimenting more precise results had been obtained. The rate of change of resistance per unit increase of field at constant temperature and the rate of change per unit increase of temperature of this magnetic rate of change in a given field being distinguished as the magnetic change rate and the thermal variation respectively, the general conclusions were : (1) the magnetic change rate of resistance of a given nickel wire increases steadily with increase of field, but at a somewhat slower rate as the field increases ; (2) the magnetic change rate increases slightly but unmistakably with rise of temperature up to 100° C. and probably higher ; (3) the thermal variation of this change rate is greater at 40° than at 75° in fields higher than about 40, but tends to be less at the lower temperature in fields smaller than 35 or 40 C.G.S. units ; (4) the change of resistance due to a field applied in a given direction is greater when the immediately preceding field has had the same direction than when it has had the opposite direction. The results were discussed along the lines of Prof. J. J. Thomson's theory of electrified corpuscles.—Prof. Alexander Smith, in continuation of a previous paper on the freezing point of sulphur, communicated a note on causes which determine the formation of amorphous sulphur. The proportion of amorphous sulphur formed in a mass of sulphur purified by crystallisation and kept heated at 448° C. was found to increase with the time which elapsed between the purification and the heating, and to decrease as the heating was greatly prolonged. Passing certain gases such as air, dry sulphur dioxide and dry hydrogen chloride through the sulphur during the heating increased the yield of amorphous sulphur ; and under these conditions long continuation of the treatment did not cause any reduction in the yield. On the other hand, nitrogen, carbon dioxide, hydrogen sulphide and ammonia, used similarly from the beginning of the heating, seemed to prevent the formation of the amorphous form. It was not advisable to offer any theory until further work had been done.

PARIS.

Academy of Sciences, August 4.—M. Bouquet de la Grye in the chair.—Reflection and refraction as regards transparent bodies in rapid motion : reflected and refracted waves : amplitude of vibrations, by M. J. Boussinesq.—Experimental demonstration of the decomposition of carbon dioxide by leaves exposed to light, by MM. P. P. Dehérain and E. Demoussy. The authors point out that when the ordinary method of immersing leaves in a saturated solution of carbon dioxide is followed, the results are invariably successful with normally submerged aquatic plants like *Ceratophyllum submersum*, but vary greatly with plants the leaves of which normally decompose carbon dioxide in air. The results are satisfactory if the leaves

are placed in air above a saturated solution of carbon dioxide. The volume of oxygen liberated was invariably found to be exactly equal to that of the carbon dioxide decomposed, and no appreciable quantities of carbon monoxide, hydrogen, or gaseous hydrocarbons were formed.—The fruits of *Rosellinia necatrix*, by M. Ed. Prillieux. One of the common parasites which destroy the roots of fruit trees and vines was named *Dematophora necatrix* by Hartig, although he pointed out that it seemed to be closely allied to the group Rosellinia. The author has for the first time been able to study thoroughly the fruits, and as the parasite without doubt belongs to that group suggests a change of name.—Direct reduction of oxides of nitrogen by the contact method, by MM. Paul Sabatier and J. B. Senderens. A study has been made of the action of reduced nickel and reduced copper on the oxides of nitrogen. The results obtained are shown to be similar to those produced by spongy platinum, and it is pointed out that nickel or copper might with advantage replace platinum for such reactions — Measurement of the limit of elasticity of metals, by M. Ch. Fremont.—On a new method of optically measuring the thickness of plates, by MM. J. Mace de Lepinay and H. Buisson (*cf. C. R.*, April 21). Results are given for a plate of quartz showing the great accuracy of the method.—Reflection of light from an iron mirror magnetised perpendicularly to the plane of incidence, by M. P. Camman. The author confirms experimentally the theory of M. C. H. Wind (*Archives néerlandaises*, 2e serie, t. i. 1897) regarding the reflection of light from magnetised mirrors, viz., if the incident light is polarised in the plane of incidence, the magnetisation has no effect upon the reflection, but if the incident ray is polarised perpendicularly to the plane of incidence, the time, the phase and the amplitude of reflected rays are changed.— Method of regulating resonators for high-frequency discharges with a view to their use in medicine, by M. H. Guilleminot.— On gentiobiose : preparation and properties of crystallised gentiobiose, by MM. Em. Bourquelot and H. Hérissey (*cf. C. R.*, cxxxii., March 4, 1901, p. 571).—Ammoniacal anhydrous copper chlorides : cupro-ammoniacal radicles, by M. Bouzat. The author finds that besides the compounds (*a*) $CuCl_2.6NH_3$ and (*c*) $CuCl_2.2NH_3$ described by Rose and Graham respectively, there is a third intermediate compound (*b*) $CuCl_2.4NH_3$. He assigns to them the constitutional formulæ

$$(a)\ Cu\left\langle{\begin{matrix}NH_2\\NH_2\end{matrix}}\right\rangle 2HCl\ ;\ (b)\ Cu\left\langle{\begin{matrix}NH(NH_4)\\NH(NH_4)\end{matrix}}\right\rangle 2HCl\ ;$$

$$(c)\ Cu\left\langle{\begin{matrix}N(NH_4)_2\\N(NH_4)_2\end{matrix}}\right\rangle 2HCl.$$

—Action of nitrous acid in alkaline solution on α-substituted β-ketonic esters, by MM. Bouveault and René Locquin. The conclusion arrived at is that if the reaction is carried out under such conditions that the ester group is not saponified, or if it be saponified in acid solution, there results an acid and an oxime of a substituted glyoxylic ester; but if, during the reaction, the ester group is saponified in such a manner as to give the salt $R—CO—CH\left\langle{\begin{matrix}COOMe\\R'\end{matrix}}\right.$, one obtains a monoxime of an α-diketone and carbonic anhydride.—Antiparamœcious serum, by M. Ledoux-Lebard. The author finds that the serum of rabbits and guinea-pigs which have been several times injected with cultures of *Paramoecium caudatum* is much more toxic towards this species of Paramœcium than normal serum. The toxic effect is less towards other species of Paramœcium (*e.g. P. aurelia*).—Action of alcoholic fermentation on the *Bacillus typhosus* and the *Bacillus Coli*, by MM. E. Bodin and F. Pailheret. Alcoholic fermentation does not seem of itself to destroy these bacilli.— Variation of the phosphoric acid in cow's milk with time after calving, by MM. F. Bordas and Sig. de Raczkowski. The phosphoric acid diminishes steadily from the time of calving. — Researches on the assimilation of leaves, influenced by chlorophyll, of which the upper or lower surfaces may be exposed to light, by M. Ed. Griffon.—On the cavern of Höll-Loch (Hell's Cavern) and the Schleichende Brunnen (Creeping Springs), Switzerland, by M. E. A. Martel. This cavern, discovered in 1880, is one of the most remarkable in Europe. It lies near Stalden. A description is given.

NEW SOUTH WALES.

Linnean Society, June 25.—Mr. J. H. Maiden, president, in the chair.— By the wish of the council, the president explained to the meeting that, in consequence of the retrenchment policy which untoward circumstances had forced upon the neighbouring State of Queensland, it was to be feared that Mr. F. M. Bailey's "Queensland Flora," now in course of publication, would be brought to an abrupt termination in the middle of the sixth or concluding part. An expression of the views of scientific men in other States would perhaps help to justify the Queensland Government in making some special effort to utilise to the full Mr. Bailey's experience and unrivalled knowledge of the flora of Queensland in completing the important publication in question. On the motion of the president it was unanimously resolved, "That this meeting desires respectfully to give expression to the hope that, in the interests of science, the Queensland Government may see its way to allow Mr. F. M. Bailey to take the steps necessary to complete the 'Queensland Flora.'" —Notes on *Juncus holoschœnus*, R. Br., and *J. prismatocarpus*, R. Br., and on certain other New South Wales plants, by Mr. E. Cheel.—(1) On *Eucalyptus Baueriana*, Schau ; (2) on *Eucalyptus calycogona*, Turcz, by Mr. J. H. Maiden. —A new gum (Levan) bacterium from a saccharose exudate of *Eucalyptus Stuartiana*, by Mr. R. Greig Smith.—*Eucalyptus melanophloia*, F.v.M., and its cognate species, by Mr. R. T. Baker. The object of the paper is to show that previous descriptions of this species must now be modified, as the foliage has not that constancy of form that has up to the present time been attributed to it.

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